

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (original) A separation apparatus comprising:
a channel through which a sample containing components-to-be-separated moves;
one, or two or more check valves disposed in said channel, suppressing back flow of said components-to-be-separated;
a plurality of compartments partitioned by said check valve(s); and
an external force imposing unit imposing external force to said components-to-be-separated so as to allow them to move through said channel,
wherein said external force imposing unit has a function of alternately executing a first external force imposing pattern by which the external force is imposed to said components-to-be-separated in the forward direction along said channel, and a second external force imposing pattern by which the external force is imposed to said components-to-be-separated in the direction opposite to the forward direction along said channel, to thereby fractionate said components-to-be-separated into any of said compartments.

2. (original) The separation apparatus according to claim 1, wherein said channel is formed so as to extend in a straight form.

3. (currently amended) The separation apparatus according to claim 1, wherein said channel has one end where a sample introduction port is provided and the other end placed downstream of said one end,

said check valves are formed so as to block back flow of at least a part of said components-to-be-separated to an upstream side, and

said separation apparatus is structured such that when said first external force imposing pattern is imposed, a first portion of said components-to-be-separated is moved in the downstream compartment of one of the check valves and a second portion of said components-to-be-separated is remained in the upstream compartment of said one of the check valves, and when said second external force imposing pattern is subsequently imposed, said first portion is prevented from being moved back to said upstream compartment and said second portion moves toward said one end of said channel in said upstream compartment, to thereby fractionate said components-to-be-separated into any of said compartments by repeating imposing said first external force imposing pattern and said second external force imposing pattern.

4. (previously presented) The separation apparatus according to claim 1, wherein said external force imposing unit includes a plurality of electrodes provided to both ends of said channel, and has a function of executing said first external force imposing pattern and said second external force imposing pattern by changing direction of voltage to be applied between said electrodes.

5. (currently amended) A separation apparatus comprising:

a channel through which a sample containing components-to-be-separated moves, said channel having a plurality of compartments partitioned by one, or two or more bent portions of said channel;

~~interception units intercepting said components-to-be-separated moving through said channel in the sample forwarding direction of said channel;~~

~~a plurality of compartments partitioned by adjacent ones of said interception units; and~~

an external force imposing unit imposing a plurality of external force imposing patterns having different imposing directions from each other to said components-to-be-separated so as to allow them to move through said channel,

wherein said external force imposing unit has a function of ~~sequentially executing a plurality of external force imposing patterns differing in external force component in the~~

~~sample forwarding direction in the channel in the individual~~
~~compartments, so as to fractionate said components to be~~
~~separated into any of said compartments~~ imposing a first external
imposing pattern having a certain imposing direction so that a
portion of said components-to-be-separated is intercepted by one
of said bent portions, and subsequently imposing a second
external imposing pattern having a different imposing direction
from said certain imposing direction such that said portion of
said components-to-be-separated intercepted by said one of said
bent portions is moved to the downstream next compartment.

6. (original) The separation apparatus according to Claim 5, wherein said external force imposing unit is configured to impose external force so as to substantially equalize magnitude of the external force imposed to said components-to-be-separated in each of said compartments.

7. (previously presented) The separation apparatus according to Claim 5, wherein said external force imposing pattern is such as imposing external force so that the compartments expressing a positive external force component and the compartments expressing a negative external force component alternately appear along the sample forwarding direction of said channel.

8-9. (canceled)

10. (currently amended) The separation apparatus according to claim 5, further comprising recovery units recovering said components-to-be-separated fractionated into said individual compartments from said ~~interception units~~ bent portions,

wherein said external force imposing unit imposes external force also between each of said recovery units and said ~~interception units~~ bent portions, so as to move said sample towards said ~~interception unit~~ bent portion during fractionation of said sample, and so as to move said sample towards said recovery unit during recovery of said sample.

11. (previously presented) The separation apparatus according to claim 1, wherein said plurality of compartments placed along the sample forwarding direction of said channel are configured so that the one placed on the further downstream side of said channel has a larger length.

12. (previously presented) The separation apparatus according to claim 1, wherein said plurality of compartments placed along the sample forwarding direction of said channel are configured so that the one placed on the further downstream side of said channel is imposed with a smaller external force in said individual external force imposing patterns.

13-15. (canceled)

16. (currently amended) A separation apparatus comprising:

a channel having a main channel and sub channels formed as being branched out from said main channel, through which a sample including components-to-be-separated moves, said main channel having one end where a sample introduction port is provided and the other end placed downstream of said one end; and

an external force imposing unit imposing a plurality of external force imposing patterns having different imposing directions from each other to said components-to-be-separated so as to allow them to move through said channel,

wherein said external force imposing unit ~~is~~ ~~configured so as to sequentially execute a plurality of external force imposing patterns differing in direction of imposition of the external force relative to said channel, and said apparatus is configured so as to fractionate said components-to-be-separated into any of said sub channels, through execution of said plurality of external force imposing patterns~~ has a function of imposing a first external imposing pattern having a certain imposing direction from said one end to the other end of said main channel so that a portion of said components-to-be-separated is moved to the downstream of the connecting position of said main channel and one of said sub channels in said main channel and subsequently imposing a second external imposing pattern having a different imposing direction from said certain imposing direction so that at least a part of said portion of said

components-to-be-separated moved to the downstream of said connecting position is moved into said one of said sub channels.

17-20. (canceled)

21. (original) A separation method using a separation apparatus comprising a channel through which a sample containing components-to-be-separated moves, a plurality of compartments provided to said channel, and an external force imposing unit imposing external force to said components-to-be-separated so as to allow them to move through said channel,

wherein said external force is repetitively imposed sequentially in the direction departing from a sample introduction position and in the direction approaching the position on said channel, to thereby fractionate said components-to-be-separated into any of said compartments.

22. (original) The separation method according to Claim 21, wherein said components-to-be-separated are fractionated into any of said compartments depending on migration ranges caused by imposition of said external force.

23. (previously presented) A separation method separating components in a sample using the separation apparatus described in claim 1, comprising:

a step of introducing said sample into said channel;

a first step of executing any one of said external force imposing patterns so as to move, within one compartment, said sample towards the downstream side of said channel;

a second step of executing any one of said external force imposing patterns so as to move, within one compartment, said sample towards the upstream side of said channel;

wherein these steps being sequentially repeated.

24. (original) The separation method according to Claim 23, wherein duration of time of imposing the external force is kept constant for every execution, in said external force imposing pattern in said first step.

25. (original) The separation method according to Claim 23, wherein duration of time of imposing the external force is kept constant for every execution, in said external force imposing pattern in said first step, and in said external force imposing pattern in said second step.

26. (previously presented) The separation method according to claim 23, wherein duration of time of imposing the external force in said external force imposing pattern in the second step is adjusted to substantially equal to, or longer than the duration of time of imposing the external force in said external force imposing pattern in the first step.

27-29. (canceled)

30. (currently amended) A separation method separating components in a sample using the separation apparatus described in claim 16, comprising:

a step of introducing said sample into said channel;

a first step of executing, ~~in said main channel, any one of said external force imposing patterns~~ said first external imposing pattern so as to move said sample towards the downstream side of said channel so that a portion of said components-to-be-separated is moved to the downstream of the connecting position of said main channel and one of said sub channels in said main channel;

a second step of executing, ~~in said main channel, any one of said external force imposing patterns so as to move said sample towards the upstream side of said channel~~ said second external imposing pattern so that at least a part of said portion of said components-to-be-separated moved to the downstream of said connecting position is moved into said one of said sub channels;

wherein these steps being sequentially repeated.

31. (original) The separation method according to Claim 30, wherein in said external force imposing pattern in said first step, duration of time of imposing the external force is kept constant for every execution.

32-33. (canceled)

34. (previously presented) A system comprising an external force switching control unit executing the method described in claim 21.

35. (previously presented) A mass spectrometry system comprising:

a pre-treatment unit separating a biological sample depending on the molecular size or properties, and subjecting said sample to a pre-treatment for an enzyme digestion treatment;

a unit subjecting said sample pre-treated by said pre-treatment unit to the enzyme digestion treatment;

a drying unit drying the enzyme-digestion-treated sample; and

a mass spectrometry unit subjecting the dried sample to mass spectrometry, wherein said pre-treatment unit comprises a microchip described in claim 1.

36. (new) The separation apparatus according to Claim 5, wherein said plurality of compartments placed along the sample forwarding direction of said channel are configured so that the one placed on the further downstream side of said channel has a larger length.

37. (new) The separation apparatus according to Claim 5, wherein said plurality of compartments placed along the sample forwarding direction of said channel are configured so that the one placed on the further downstream side of said channel is imposed with a smaller external force in said individual external force imposing patterns.

38. (new) The separation method according to Claim 21, wherein said separation apparatus further includes one, or two or more suppressing portions, each of said suppressing portions being formed so as to block the back flow of at least a part of

said components-to-be-separated to the upstream and partitioning said channel into an upstream compartment and a downstream compartment, and wherein said method comprising:

imposing a first external imposing pattern having a certain imposing direction from the upstream to one of said suppressing portions; and

after said imposing the first external imposing pattern, imposing a second external imposing pattern having a different imposing direction from said certain imposing direction such that the separation of a first portion of said components-to-be-separated which has passed said one of suppressing portions and a second portion of said components-to-be-separated which has not passed said one of suppressing portions is accelerated.

39. (new) The separation method according to Claim 21, wherein said separation apparatus further includes one, or two or more suppressing portions, each of said suppressing portions being formed so as to block the forward flow of at least a part of said components-to-be-separated to the downstream and partitioning said channel into an upstream compartment and a downstream compartment, and wherein said method comprising:

imposing a first external imposing pattern having a certain imposing direction from the upstream to one of said suppressing portions; and

after said imposing the first external imposing pattern, imposing a second external imposing pattern having a

different imposing direction from said certain imposing direction such that the separation of a first portion of said components-to-be-separated which has reached at said one of suppressing portions and a second portion of said components-to-be-separated which has not reached at said one of suppressing portions is accelerated.